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(54) Bag cutting apparatus

(57) A bag cutting apparatus comprising means 12 for advancing bags 10 or 11 through a cutting station, which includes a pair of spaced parallel cutting discs 22, 23, with a knife 25 carried between them, the discs and knife being rotated in a direction opposite to the direction of advance of bags 10 or 11 through the apparatus, and a hopper 14 to receive the material falling from the cut bags. The discs are in cutting cooperation with fixed strips (not shown), and the knife may cut in the down- or upward direction. Further cutting discs 27, 28 may be provided and vibratory means e.g. flails (not shown) for striking the top of the bags to dislodge their contents.

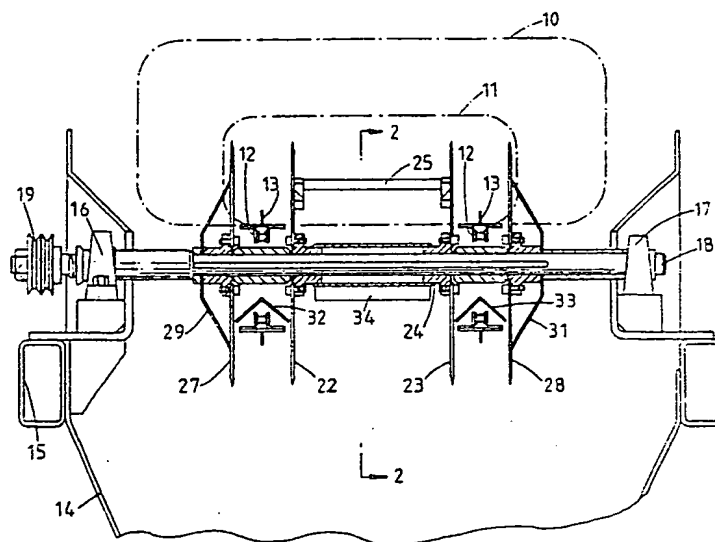
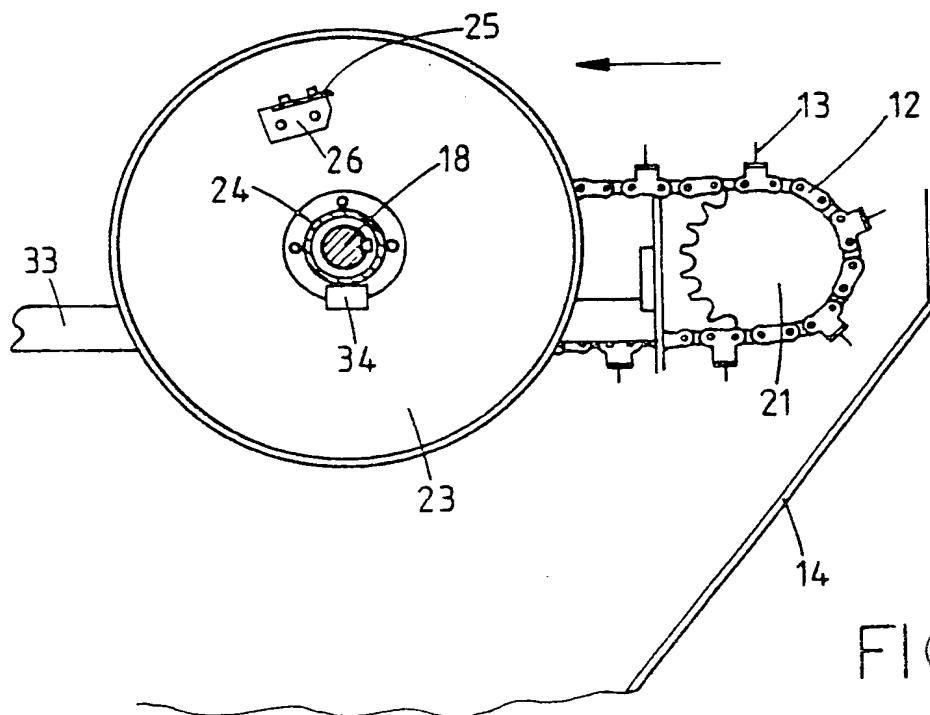
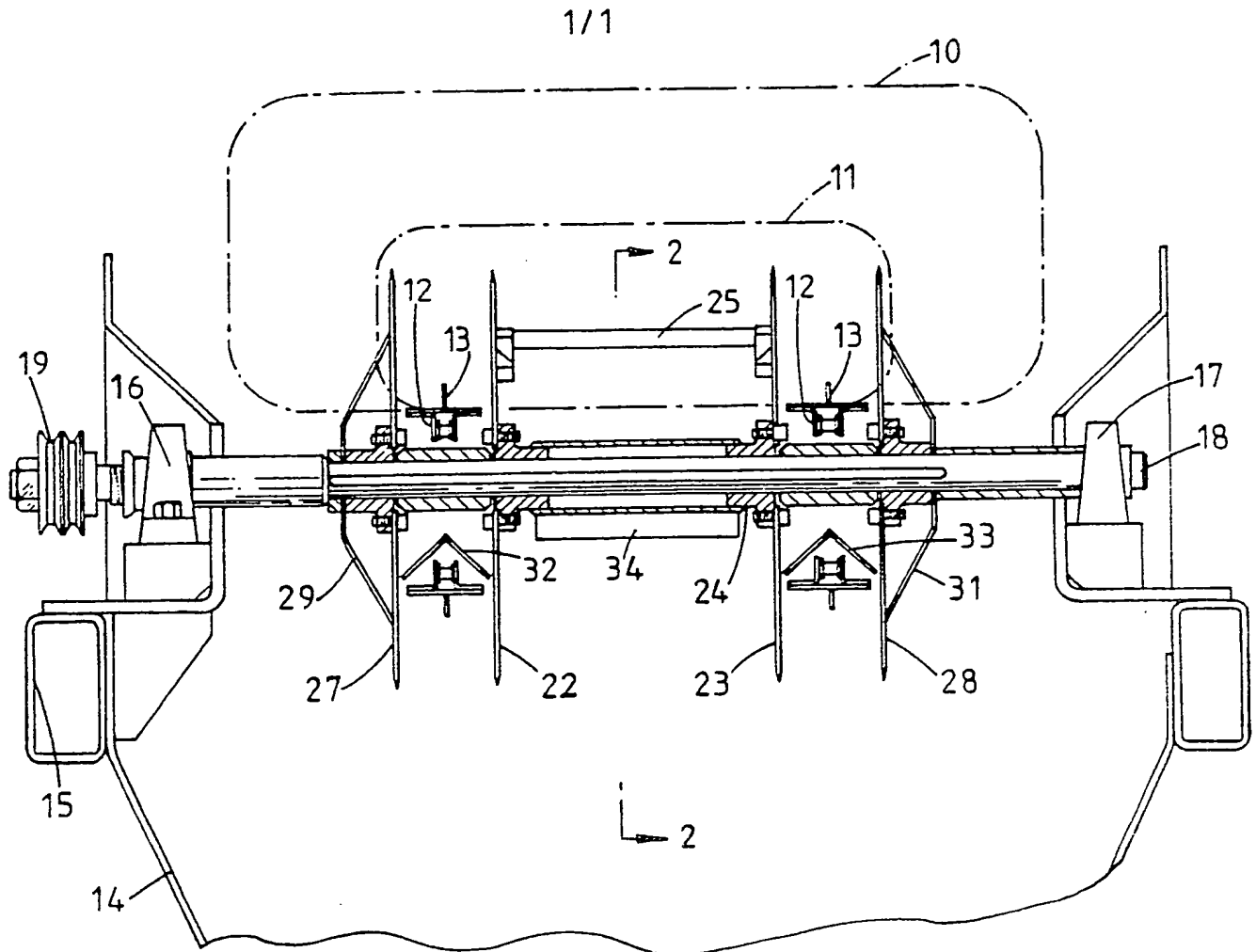


FIG. 1.

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SPECIFICATION

Bag cutting apparatus

5 This invention relates to apparatus for cutting open bags, so as to allow the contents to be discharged.

Bags made from paper, plastics sheeting, hessian or other material, typically containing milk powder, asbestos, or other powdered or granular material
10 can be opened by the apparatus.

Traditionally, bags of this kind are simply split with a knife or other tool, often in random manner, and then tipped up to empty the contents, but this often results in spillage and consequent waste of the material contained in the bag. It has therefore been proposed to place the bags on a conveyor system and, at a cutting station, to slit the bag and pull it open, using various grippers, or to rip it open using claws. In other forms the whole bag, or at least part of it, is cut
20 up or ripped up and the mixed contents and pieces of bag are sieved to remove the bag pieces. In all cases the thorough emptying of bags is not ensured, and in the case of apparatus which cuts or rips the bags up, a further operation is needed to separate the material
25 from the pieces of bag.

It is thus the object of the present invention to provide apparatus for cutting open bags in a particularly efficient manner, to enable the whole contents to be discharged quickly and efficiently.

30 In accordance with the present invention there is provided a bag cutting apparatus comprising means for advancing bags through a cutting station, a mechanism at the cutting station including a pair of spaced generally parallel rotatable cutting discs and a knife disposed between the discs, the arrangement
35 being such that a bag travelling through the said section is slit lengthwise of the direction of travel in two spaced positions by the pair of discs and the portion of the bag between the slits is cut open by the knife.

40 It is preferred that the discs, with the knife, should be rotatable about an axis which is transverse to the direction of travel of the bags through the cutting station.

Preferably, the knife is straight and is secured at its
45 two ends to the respective cutting discs, the knife extending parallel or at a small angle relative to the axis of rotation of the discs and being situated at a distance spaced radially from the peripheries of the discs.

50 Conveniently, the means for advancing the bags through the cutting station comprise a conveyor carrying spikes for gripping or penetrating the bags.

Preferably also, a further pair of cutting discs are provided outside the first mentioned two discs and
55 rotatable with the further pair of discs, being arranged to make further slits in the bags to facilitate emptying of the lateral edge portions of the bags.

Advantageously the cutting apparatus is fitted over a hopper into which the material discharged
60 from the bags will fall.

The invention will now be described by way of example with reference to the accompanying drawings in which;

65 *Figure 1* is a cross sectional view of bag cutting apparatus constructed in accordance with the inven-

tion; and

Figure 2 is a side elevation cross section on a line 2-2 in *Figure 1*.

The apparatus shown is designed for cutting open
70 bags of powdered or granular material, typically being of 25 kilogram weight. It is however, to be understood that the apparatus can be scaled up or down to suit other requirements. *Figure 1* shows two typical bag sizes at 10 and 11. Bags may be made
75 from paper, plastics sheeting, hessian, or other material capable of being cut by a knife or sharp edge.

The apparatus includes means for conveying bags in turn to the cutting station illustrated. A conveyor in the form of two parallel link type chains 12 is provided. Spaced links include spikes 13 which are intended to grip or even to penetrate the bags. Associated bag advancing apparatus (not shown) is provided for bringing the bag onto the conveyor chains.

At the cutting station, there is a hopper 14 into
85 which contents of bags can be discharged in a manner to be described. The hopper is carried on a frame 15 on which is mounted a pair of spaced bearing assemblies 16, 17, for a shaft 18 extending perpendicularly to the direction of travel of the bags
90 through this station. The shaft carries drive pulleys 19 at one end, by means of which it is rotated in timed sequence with the conveyor. The chains 12 are carried on sprockets, one of which is shown in *Figure 2* at 21, and a suitable drive system (not illustrated) is provided for synchronised running of the chains and
95 of the shaft 18.

Carried on the shaft, generally over the centre of the hopper 14 are two cutting discs 22, 23. These are connected by a hub 24 and also by a straight knife
100 blade 25. This knife blade is secured to the respective discs 22, 23, by brackets 26, and is located at a position spaced radially inwardly of the peripheries of the discs 22, 23. The sharpened edge of the knife 25 is presented in a nearly circumferential direction with respect to the axis of the shaft 18 on which the discs
105 22, 23 are carried. The knife in this example is straight and is set perpendicular to the direction of travel of bags, but it is possible to use a knife which is inclined so that one end of the knife meets the bag before the other. A slicing action is thus achieved. A curved or other shaped knife may also be used. A counter weight 34 is positioned to counterbalance the knife 25. As will be described, the knife 25 is travelling generally upwardly when it meets the oncom-
115 ing bag.

Outside the two discs 22, 23, are respective further discs 27, 28 of the same diameter as the discs 22, 23, and spaced apart from them to leave respective access spaces for the chains 12. The return runs of the chains 12 may be beneath covers 32, 33 to protect the chains from falling material.

Attached to the two outer discs 27, 28 are dished washers 29, 31, and there are also inclined guide plates (not illustrated) which are situated beside the two outer discs 27, 28 and on the outermost sides thereof. Adjacent to the discs 22, 23 there are fixed strips (not shown) which are close enough to the discs to provide a scissor type action as the discs rotate, to improve cutting action.

130 In use, bags are advanced on the chains 12 and

their forward motion is ensured by engagement with the spikes 13. As the forward end of the bag enters the cutting station in the direction indicated by the arrows in Figure 2, the discs 22, 23 which are rotating at a speed substantially greater than the speed of advance of the bag and in the opposite or clockwise direction, will enter the bag to cut two parallel longitudinal slits. As the cutting discs 22, 23 rotate, the straight knife blade 25 is brought up towards the position shown in Figure 2, to slit the bag transversely of its direction of travel. The cut will take place across the centre of the bag near its forward edge and substantially right across, between the slits made by the discs 22, 23.

A flap will thus be formed on the underneath side of the bag and this will open as the knife 25 repeatedly enters the interior of the bag. The contents will thus fall out, principally by gravity, but may be aided by the ploughing action created by the knife 25. As the bag travels through the cutting station, the outer cutting discs 27, 28 will also slit the bag lengthwise simultaneously with the slits made by the cutting discs 22, 23. This will assist in ensuring that any material at the lateral edges of the bag will be discharged. The guides (not shown), and the dished washers 29, 31 will tend to push the sides of the bags open further to facilitate the emptying action. The speed of rotation of the discs and the knife is sufficient to ensure that at least approximately 10 or more complete turns are carried out during travel of the bag from beginning to end of the opening operation.

To further assist removal of the contents, flails may be used to strike the top of the bag, or other vibratory means may be used to dislodge any material which may be stuck to the top of the bag.

Since there will be no resistance to the movement of the cut flap on the underneath of the bag as the bag travels forward through the cutting station, there will be no tendency for the flap to be cut off by the knife 25 but this will simply push it aside. In this way, pieces of bag will not drop into the hopper with the material being discharged from the bag. In order to assist in removal of an empty bag, the blade rotation can be reversed, and at the same time the speed of rotation may be reduced. At this stage therefore, the discs may be rotating at the speed of the conveyor and in the same direction.

Spacing of the bags as they travel through the station will tend to ensure against any resistance offered against the knife 25 at the back of the bag.

To remove the bags from the chains after they have been emptied, the chains may pass into the interior of a cage which tends to lift the bag off the spikes. The cage may be non-circular to provide an uneven lifting action which will also assist in dislodging any material still remaining attached to the bag, and material adhering to the spikes or other parts of the chains.

When lightweight bags are being opened, there is some risk that the bags will lift over the discs without being cut. To avoid this, an alternative arrangement provides a knife which meets the front of a bag while that knife is travelling downwards, instead of upwards, as in the arrangement described. A different

shape of blade, possibly including teeth on the cutting edge, is conveniently provided. Means may also be provided to support the bag outside the discs, to stop the bag being forced downwards bodily.

Brushes and/or air flow may be used to assist in removal of material, particularly from the region between the inner and outer discs, over the conveyor chain.

75 CLAIMS

1. A bag cutting apparatus comprising means for advancing bags through a cutting station, a mechanism at the cutting station including a pair of spaced generally parallel rotatable cutting discs and a knife disposed between the discs, the arrangement being such that a bag travelling through the said station is slit lengthwise of the direction of travel in two spaced positions by the pair of discs, and the portion of the bag between the slits is cut open by the knife.

2. A bag cutting apparatus as claimed in Claim 1 in which the discs carry the knife between them and are mounted for rotation about an axis transverse to the direction of travel of the bags through the cutting station.

3. A bag cutting apparatus as claimed in Claim 1 or Claim 2 in which the knife is secured to the two discs to extend between them and is spaced radially from the peripheries of the said discs.

4. A bag cutting apparatus as claimed in any one of the preceding claims wherein the knife is substantially straight and is perpendicular, or at a small angle from the perpendicular, relatively to the discs.

5. A bag cutting apparatus as claimed in any one of the preceding claims wherein there are two further discs disposed respectively outside the first mentioned pair of discs, said further discs being rotatable with the said first mentioned pair of discs.

6. A bag cutting apparatus as claimed in Claim 5 in which the further discs carry bag spreader members to assist in opening out the lateral edges of bags being cut.

7. A bag cutting apparatus as claimed in any one of the preceding claims wherein the means for advancing bags through the cutting station comprises a pair of spaced conveyors having means for gripping or penetrating the bags.

8. A bag cutting apparatus as claimed in Claim 7 in which the conveyors are link type chain conveyors driven in parallel and having spikes to grip or penetrate the bags.

9. A bag cutting apparatus as claimed in any one of the preceding claims having means for driving the discs in a direction counter to the direction of travel of the bags through the cutting station.

10. A bag cutting apparatus as claimed in any one of the preceding claims including a hopper at the cutting station into which material from the cut open bags will fall.

11. A bag cutting apparatus as claimed in any one of the preceding claims including means for assisting in removal of any material which does not fall out of the bags being cut.

12. A bag cutting apparatus as claimed in Claim 10 in which said means includes flails, brushes, and

means for supplying air under pressure.

14. A bag cutting apparatus substantially as here-
inbefore described with reference to and as shown in
the accompanying drawings.

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